

REMARKS

Claims 1-10 are pending in the present application. Claims 1-10 are rejected. Claim 9 is herein canceled. Claims 1 and 8 are herein amended. No new matter has been entered.

Specification

The Examiner asserts that the title of the invention is not descriptive. Applicants herein amend the title as follows: Nickel Hydrogen Secondary Battery Having Improved High-Temperature Charging Efficiency.

The Examiner asserts that the abstract of the invention does not comply with Patent Office rules. Other than a typographical error (an “s” appears in place of a “z” at the end of the general formula), Applicants note that the abstract as submitted in the specification appears to be inadvertently comprised of two paragraphs, and includes 155 words, which is just above the preferred maximum of 150 words. Applicants herein amend the abstract to correct the typographical error, and to reduce the number of words contained in the Abstract to 149.

Claim Rejections - 35 U.S.C. §103

Claims 1-10 are rejected under 35 U.S.C. §103(a) as being unpatentable over Kohno et al. 6130006 in view of the Japanese publication JP 10-294109 (JP ‘109).

The Examiner asserts that Kohno et al. discloses in Figure 2 a battery comprising a case 1, a positive electrode 2, a negative electrode 4, and a separator 3, and alkaline electrolyte (COL 32, line 14 to COL 33, line 60/ FIGURE 2). The positive electrode of Kohno et al. includes a nickel

hydroxide powder; and may also contain at least one oxide or hydroxide of metal selected from the group consisting of zinc and cobalt (COL 32, lines 49-62). The negative electrode of Kohno et al. includes a hydrogen-absorbing alloy powder (COL 33, lines 5-10).

With respect to claim 2 reciting a cobalt compound coated on the nickel hydroxide, the Examiner concludes that it would have been obvious to use a cobalt compound coating on the nickel hydroxide of the positive electrode of Kohno et al. as taught by the JP '109 because the JP '109 discloses that positive electrodes including such a coating material have an excellent charging characteristic particularly at a high temperature.

With respect to claim 7, the Examiner asserts that JP '109 discloses nickel electrodes for alkaline storage battery (TITLE) wherein the nickel electrode includes a covering layer composed of a Na-containing Co compound formed on the surface of the nickel hydroxide particle (ABSTRACT).

The Examiner notes that Kohno et al. discloses that conductive materials can be added to the nickel hydroxide, and contends that the claimed average valency behavior (i.e. higher than 2) of the nickel contained in the nickel hydroxide is an *inherent* characteristic thereof:

- (1) because of the addition of more conductive material, specifically Co, which the Examiner asserts tends to alter valency upon interaction with Ni, and
- (2) because during charging and discharging cycles the nickel hydroxide is compelled to take transitional states for electrochemical reaction purposes.

Kohno et al. fails to include a teaching that the positive electrode contains at least one element selected from a group consisting of Yb, Er, Ca, Sr, Ba, Nb, Ti, W, Mo and Ta.

The Examiner notes that JP '109 teaches nickel electrodes for alkaline storage battery wherein the nickel hydroxide electrode contains Y₂O₃ powder. The Examiner asserts that it would have been obvious to combine the cited references.

Amendments and Discussion

Applicants herein amend the claims to clarify the invention. Thereafter, Applicants disagree with the rejection because the cited combination of references fails to teach or suggest all the claimed limitations.

Applicants note that an object of the present invention is to solve the problem that the battery capacity decreases when continuous charging is performed at high temperature (page 4, lines 7-16; paragraph [0014]).

To achieve the object, the present invention provides a nickel-hydrogen secondary battery which is characterized in that the positive electrode contains nickel hydroxide and at least one element selected from the group consisting of Yb, Er, Ca, Sr, Ba, Nb, Ti, W, Mo and Ta, and that the negative electrode contains a hydrogen-absorbing alloy having composition represented by the general formula: Ln_{1-x}Mg_x(Ni_{1-y}T_y)_z, as recited in claim 1.

The secondary battery according to claim 4 is characterized in that the average valency of nickel contained in the nickel hydroxide is higher than 2.

The battery of claim 5 is characterized in that the average valency of nickel contained in the nickel hydroxide is in the range of 2.05 to 2.30.

The battery according to claim 6 is characterized in that the average valency of nickel contained in the nickel hydroxide is in the range of 2.10 to 2.30.

With the battery construction recited in claim 1, the Mg taken in the positive electrode restrains production of gamma nickel oxyhydroxide in continuous charging, and even if gamma nickel oxyhydroxide is produced, it restrains the alkaline electrolyte from being absorbed into the positive electrode (page 10, lines 22-27; paragraph [0044]). As a consequence, the aforementioned object of the present invention is achieved.

Moreover, in the battery according to claims 4 to 6, when the assembling of the battery is completed or when the battery is discharged 100% or more, the average valency of nickel contained in the nickel hydroxide is higher than 2. This leads to a decrease in the amount of irreversible hydrogen, namely hydrogen which remains absorbed in the negative electrode and is not released therefrom (page 8, lines 2-19; paragraph [0032]).

Kohno et al. does not teach any of the object of the present invention, the battery construction as recited in claims 1 and 4 to 6, and the advantages obtained thereby. Especially, regarding the battery of claims 4 to 6, it should be noted that the addition of Co does not necessarily make the valency of Ni higher than or equal to 2.0.

Also, it is commonly known that the valency of Ni becomes 2 or higher in the process of battery cell reaction, and one having ordinary skill in the art would not interpret claims 4 to 6 as the Examiner did in the Office Action. The battery according to claims 4 to 6 is characterized by the nickel hydroxide being subjected in advance to chemical oxidation process or the like such

Application No. 10/720,700
Attorney Docket No. 032134

Amendment under 37 C.F.R. §1.111
Amendment filed: December 14, 2006

that when the assembling of the battery is completed or when the battery is discharged 100% or more, the average valency of nickel contained in the nickel hydroxide is higher than 2.

Applicants note that JP '109 does not teach any the object of the present invention, the battery construction as recited in claims 1 and 4 to 6, and the advantages obtained thereby. Further, even the combination of JP '109 and Kohno et al. fails to teach or suggest that the positive electrode contains at least one element selected from a group consisting of Yb, Er, Ca, Sr, Ba, Nb, Ti, W, Mo and Ta.

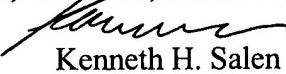
In view of the aforementioned amendments and accompanying remarks, Applicants submit that that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

WESTERMAN, HATTORI, DANIELS & ADRIAN, LLP


Kenneth H. Salen
Attorney for Applicants
Registration No. 43,077
Telephone: (202) 822-1100
Facsimile: (202) 822-1111

KHS/rf